THE SCIENCE NEWS-LETTER

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UNIVERSE IS 10,000 MILKY WAYS WIDE

The diameter of the universe is the length of 10,000 Milky Ways. And this Milky Way yardstick is 30,000 times the distance that light, travelling 186,000 miles per second, covers in one year. Light comes from the sun to the earth in about 8 minutes.

This is the conclusion of Prof. Archibald Henderson of the University of North Carolina, given in a communication in the September 8 issue of "Science". He assumed that space and the universe are constructed according to Einstein's general relativity theory.

"It would take a ray of light, traveling at the rate of 186,000 miles per second, one billion years to go around the universe," Prof. Henderson says. "To go around the universe it would take the fastest aeroplane three quadrillion years; the fastest automobile five and one half quadrillion years; and an express train, traveling at the rate of 60 miles an hour, 11 quadrillion years.

"If it is assumed that the average density of matter in the universe is the same as that of the Milky Way, the radius of the universe is at least 150 millio light-years; or since the distance from the earth to the sun is 93,000,000 miles the radius of the universe is 1 million times 10 million times the distance from the earth to the sun. The weight of the universe in grammes would be 1 followed by fifty-four ciphers, which would carry us into the nonillions of grammes.

"The weight of the Einstein universe bears the same relation to the weight of the whole earth as the latter bears to a kilogram. The weight of the earth to that of the sun is as 1 to 324,000. Hence we should have to take a trillion suns to get the weight of the universe."

Space, according to Einstein, has seemingly queer properties, Prof. Henderson says:

"Einstein has advanced the view that the universe is finite, but unbounded. This statement sounds paradoxical, but brief reflection will show that a thing may be unbounded without being infinite. A being which moves on the surface of the earth, or indeed of any sphere, may travel over it indefinitely without ever reaching any boundary or limit. Similar considerations, extended to three-dimensional curved space, enable us to see how the universe may be at the same time finite and unbounded. Assuming further the existence of pressure inside the electrically charged particles of matter in the universe, Einstein showed

by elaborate calculations based on general relativity that space is 'spherical' in structure.

"This 'spherical' space is curved space - which means that according to Einstein the geometry of our universe is not Euclidean. The universe, moreover, does not have the shape of a sphere. It is not a three-dimensional space cut out of four-dimensional space - as is a sphere a two-dimensional space cut out of a three-dimensional space. It possesses the following properties: All lines starting from a point intersect again in the antipodal point measured along any of these lines. If a stellar body move through spherical space, its size gradually increases until it reaches its maximum at the universe's outer verge; and there, as it were, reentering the universe it gradually diminishes in dimensions until it ultimately reaches its original size and position. Every point stands in the same relation to the rest of space as does every other point. There is no boundary to spherical space, and no center."

Prof. Henderson says that the question "What lies beyond?" has no meaning for Einstein because the foundation of general relativity is the doctrine that there is no space without matter or energy. If all the heavenly bodies we know belong to our galactic system, it is possible, according to Einstein, that other universes exist independently of our own. They may remain forever optically isolated from us by the phenomenon of the cosmic absorption of light.

"We are doomed to dwell within a finite universe a thousand million times greater than the region now accessible to astronomical observation," Prof. Henderson says. "While other universes may palpitate beyond our own, no ray of knowledge could ever reach us from them."

NEW RAY DISCOVERED IN ATOMIC COLLISIONS

Discovery of a new and rare sort of rays resulting from partial disintegration of atoms as a result of collisions with alpha particles, the nuclei of helium atoms, moving at a speed 30,000 times faster than a rifle bullet, was announced this afternoon to the American Chemical Society meeting in Milwaukee by Prof. W. D. Harkins, and R. W. Ryan of the University of Chicago. The discovery was made as the result of 41,000 photographs of atomic collisions.

The new rays which have been named "Zeta rays" by Prof. Harkins, are very short and are thought to be due to electrons knocked out of atoms through which the flying alpha particle speeds. He also considers it possible that they may be due to electrons picked up by the alpha particle and then discharged from it. They move in parallel tracks and in a direction nearly opposite to that of the impinging alpha particle.

Prof. Harkins' paper was illustrated with photographs and motion pictures of the atomic collisions. Although atoms are a thousand times too small to be seen by the highest powered microscopes and the electrons are many times smaller it has been found that water vapor will condense on them and that these minute droplets may, if strongly illuminated, be made visible in the microscope. The moving nuclei and rays thus leave behind them a wake of light which appears in the pictures as a fine white line.

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The alpha particles or helium nuclei with which the atoms of air were bombarded were obtained from disintegrating radium "C" which shoots them out with a velocity comparable to that of light. Each atom of air, like other atoms, consists of a nucleus and a surrounding system of electrons, similar to the sun and its planets. When a moving alpha particle passes through an atom it may or may not come into collision with a central nucleus or one of the electrons. Collisions with electrons are relatively common; those with a nucleus are very rare. When this happens the atom is smashed up beyond recovery. Many photographs of such crashes were shown by Dr. Harkins.

"What the importance of these rays may be, it is impossible to say," Dr. Harkins declared," since they are so new that their characteristics are still unknown. "They should give some new light on the structure of atoms, the emission of electrons from them, and of the nature of the electromagnetic fields of force in the vicinity of the atom. A more thorough knowledge of these fields of force should lead to important discoveries and inventions in the fields of chemistry and of physics."

EXPERT HOLDS MAN TO BLAME FOR EARTHQUAKE DAMAGE

Man, and not Nature, is to blame for the disastrous consequences of earthquakes in such localities as Japan, Chile or California, in the opinion of Dr. Bailey Willis, one of America's leading geologists who has just returned from Chile where he traced the earthquake of last November to its lair high in the Andes.

Referring to his investigations in Chile as a representative of the Carnegie Institution of Washington, Dr. Willis said to Science Service: "When it came to the point of a verdict which should place the chief responsibility for the disaster upon the right shoulders, we could not convict the earthquakes. Where nature gives warning after warning, but man remains heedless, he has but himself to blame for the consequences. So it was in Chile, so it is in Japan, and so it will be in California or wherever else earthquake risk is carelessly disregarded.

Dr. Willis is professor emeritus of geology at Stanford University and he declared that he is a good Californian except that he is inclined to take earthquakes seriously.

In an exclusive statement to Science Service, Dr. Willis tells how earthquake-proof houses may be built and he also relates his experiences in addressing the population of the town of Vallenar in Chile, badly damaged by last year's earthquake:

HOW TO BUILD EARTHQUAKE-PROOF HOUSES

By Dr. Bailey Willis

The mayor of Vallenar invited me to meet a group of gentlemen in the Union Club to talk to them about earthquakes. The president of the local workingmen's union desired a more public discussion and the mayor yielded the point. The meeting was held in a temporary theater with a capacity for about 400 people and it

was crowded. In front sat a group of officials, the priest, and the landowners. To the number of fifty they represented that portion of the audience which could read, write, and cipher. The workmen were there in force, few of them wearing anything more than shirt and trousers. There were many women, their dark faces stamped with resignation and half hidden in the black mantillas. Young girls, youths, and street urchins were scattered among their elders and some of the latter looked down from perches in the rafters. I have spoken to many audiences, but not to any that was more responsive or attentive. This was for them no academic discussion. The earthquake had been a terrible experience and before them was a man who was supposed to know how to guard against a repetition of disaster in Vallenar, or whether they must abandon their city and move to another site, as was proposed.

No one of any feeling could look into those dark, sad faces and not realize how urgent is the solution of the problem of safeguarding the people of earthquake zones from danger. In the presence of that audience it became an immediate obligation to study the causes of failure of the houses as they had been built and to discover methods of building safely with the materials and workmanship at hand.

To construct a house that will withstand an earthquake is not difficult if you can command the right materials and good carpenters, but during three hundred years it has proved to be more than the unskilled artisans of Chile could do, handicapped, as they have been by poor wood, wretched mortar, and the evil inheritance of adobe buildings. They used to put together structures that were pinned with wooden pins and tied with rawhide, which were both strong and elastic. Some of them have passed through the earthquakes of the past century without serious damage. The introduction of iron nails, which are so easily driven, appear to hold so well, but in fact pull out with ease, has resulted in much weaker frames, that are quite unequal to the task of upholding the heavy walls and roofs of adobe. Back to the good old joinery should be the cry. Rawhide should be used if convenience and cheapness require, but galvanized fencewire is better when skillfully stretched or tied. And adobe should be used only to fill thin walls, never in heavy masses.

An American frame house, well mortised and pinned, is as safe as reinforced concrete, provided the lath is replaced by fence wire on both the inside and outside of the frame. The wire can be put on in either one of two ways, parallel with both diagonals or parallel with the beams and uprights, and it should be spaced from 3 to 6 inches apart according to the size of the wall and the quality of the plaster. It must be stretched tightly to form a firm network to which the plaster can adhere and for this reason wire netting does not do as well, because it cannot be drawn as tightly as a continuous strand, which is fastened by staples at every turn.

The difference between the diagonal arrangement and the horizontal-vertical one is important. The former makes a rigid house, the latter a flexible one, and the distinction is the same as that between a springless cart and a carriage. When the quake strikes the former you will feel like a man lying on the bottom of the cart while the team runs away across a rocky pasture, whereas in the flexible house you might think you were up a tree.

There is one thing about building to resist earthquakes that people seem to forget: an earthquake can exert no more force to wreck a building than is necessary to overcome the inertia of the structure, or of some part of it. A heavy

mud-roof, such as is heaped on Chilian houses, will wreck and ruin the walls, where one of light shingles would sway with them.

Another point which has not been recognized generally by architects or engineers is that it is the earth which moves, while the house tries to stand still. If you could put a ball-bearing between your house and its foundations, instead of bolting it to them, you would not have to buy your wife a new dinner set. This idea is embodied in every instrument for recording earthquakes and was applied many years ago by Sir John Milne to the construction of a lighthouse in Japan. I have recently recommended its consideration by a firm which is contemplating the building of a warehouse on dangerous ground in Valparaiso, Chile, and I believe it can be introduced successfully in some combination of bearings, springs, or shock absorbers. For the ordinary house a broad ditch packed with cobblestones on which there rests a well braced frame of heavy beams would not be a bad substitute. It would allow the ground to slide round under the house, which could be jacked back into position with reference to such unstable things as trees, garden walks, and roads, at your convenience.

These ideas about building quake-proof houses grew by degrees as I studied not only the ruins, but also the surviving buildings. The evidence was a liberal education in how to build and how not to, and the conclusions will be published by the Carnegie Institution of Washington as a contribution to the safety of the Chilian people or of others who may be similarly circumstanced.

DUMMY DONKEY FOOLS TSETSE FLY

Dummy donkeys with sticky legs are proposed for experiments in destroying large numbers of tsetse flies, which carry the germs of the African sleeping-sickness, in a publication of the Department of Agriculture of South Africa.

R. H. Harris found that these dangerous insects were attracted to the legs of his donkey. He built a dummy animal with wooden legs covered with old bags, but the flies apparently did not discriminate between the natural and artificial limbs. He suggests construction of many such dummies covered with sticky materials to destroy the insects by the wholesale.

HIGHEST GERMAN SCIENCE AWARD 500,000 MARKS OR $1.11

The magazine, Science, published the following communication from an America Professor in Germany:

"The Prussian Academy of Science has voted this year's research grants. I have added to each its value in gold at today's rate of exchange: Professor Guth nick for thermo-electric measurements of stars, 100,000 marks, 22 cents; Professo Pompecky for his work on the Tendagusu fossils, 80,000 marks, 18 cents; Dr. F. Leng for his work on the physiology of cell-division, 20,000 marks, 4 cents. The highest award is for work on Egyptian texts, 500,000 marks, $1.11. Further comment seems unnecessary."

ELECTRIC LIGHT AND YEAST MAKE HENS LAY MORE EGGS.

By using electric lights to increase the feeding periods and putting yeast in the food, Professors A. J. Souba, H. C. Knandel and R. Adams Dutcher of Indiana University have succeeded in increasing egg production by white leghorn hens and pullets.

Ten pens of forty-five birds each were fed for ten months on wet and dry mash rations, with and without yeast and with and without artificial light. Practically all groups which received the yeast diet showed gains. Some of these differences between fowls fed with and without yeast were very slight until the feeding period was increased by artificial light. Then the yeast raised birds soon showed marked superiority in egg laying.

ALKALINE SOLUTIONS PROTECT STEEL PIPE

Dilute alkaline solution will prevent corrosion of steel pipe or of steel immersed in water, according to F. N. Speller, chemist of the National Tube Company, who spoke before the American Chemical Society at Milwaukee. The first effect is the formation of a protective coating or film which is very adherent and which diminishes greatly the subsequent corrosive action of other liquids which pass through the pipe.

INCREASE WOOD PULP RESOURCES BY NEW PROCESS

The wood pulp resources of the world may be greatly increased by the use of a new process of manufacture described by Prof. Ralph H. McKee of Columbia University.

There are several species of coniferous woods, said Dr. McKee, which are at present unsuited for manufacture into sulphite pulp because of their high content of resinous matter. The process which he described consists in dissolving out the turpentine and rosin with liquid sulphur dioxide and then converting the residue into the usual sulphite pulp which is stated to be of good quality. It was also stated that turpentine and rosin could be produced commercially by this process cheaper than by present methods.

Dr. McKee also described a new process for eliminating the nuisance of waste sulphite liquors from pulp mills. This process, which he said has been successfull and profitable on a commercial scale, depends upon the fermentation of the liquor. Commercial alcohol is obtained and the residue evaporated and used as fuel. Dr. McKee stated that the fuel so obtained from the average pulp mill is adequate to give a thousand horsepower day and night besides sufficient steam to do all the evaporation required.

Colored people are more susceptible to fatal heat prostration than white people

CORN-STALKS SOURCE OF COOKING SYRUP

Excellent cooking syrup, rivalling the best grades of sorgum and molasses, can be made from sweet corn stalks, J. J. Willaman, G. O. Burr and F. R. Davison who have been investigating this problem for two seasons in Minnesota, announced before the Sugar Division of the American Chemical Society at Milwaukee. Five varieties of sweet corn and two of field corn were used in the experiments which indicate that corn stalk syrup manufacture is commercially practical as a cannery by-product.

The experimenters found that if the stalks were allowed to stand in the field from ten to twenty days after removal of the ears, the density of the juices was increased to a maximum. The proper stage for syryp making, they said, is at this period of maximum density, both on account of the yield and the quality of the juice obtained. The manufacture of cornstalk syrup is by essentially the same process as is used in making sorgum syrup. Careful use of the by-products, the leaves and dry refuse from the crushed stalks, will be necessary in commercial practice, however.

The corn-stalk syrup is clear, reddish amber in color, and has a pleasant flavor. It is not a table syrup, but is declared suitable for cooking.

SOIL TESTS MAY PROVE METALS NECESSARY TO LIFE

Experiments now under way by Prof. J. S. McHargue, research chemist of the Kentucky Experiment Station, may show that compounds of copper, manganese and zinc, found closely associated with the so-called vitamins in animal and plant tissue, are essential to life.

Prof. McHargue reported having found appreciable amounts of lead, arsenic, copper, cadmium, manganese, zinc, nickel and cobalt in virgin and cultivated soils from three different geological formations in Kentucky.

Plants and seeds growing under natural conditions were also examined and copper, manganese, and zinc were found in all cases. In wheat, corn and rice, these three elements and also iron were discovered. The more important organs and tissues of hogs, sheep and cattle were examined and the largest amounts of copper, manganese, zinc and iron were found in the liver of each of these animals

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PRODUCE NEW CHEMICALS TO FIGHT LAWN WEEDS

How dandelions, plantin, dock, and other broad-leaved plants have been completely banished from lawns in experiments with a new chemical spray was told by F. Marion Lougee and B. S. Hopkins at the Milwaukee meeting of the American Chemical Society. Good control over bitter rot, apple scab and other fungous diseases was also indicated.

The lawn weeds were eradicated with but slight injury to blue grass and clover, but the control of the plant diseases was accompanied by considerable injury to the foliage. Selenium was used instead of the sulfur, commonly employed in such poison solutions. The most successful of these selenium sprays was found to be selenious acid and sodium selenite.

MOST BAKERS BREAD DEFICIENT DIETARY EXPERT TELLS CHEMISTS

Only one commercial white bread and no whole wheat bread of many examined was declared by Prof. Worth Hale of the Harvard Medical School in an address to members of the American Chemical Society at Milwaukee to be adequate for the growth and maintenance of growing children.

Experimental white breads made with the addition of the water extract of wheat embryo and with a small percentage of milk proved far superior to the average white or whole wheat bread, the speaker said. One commercial bread developed along these lines was found to be superior to all others and to protect animals from the so-called "deficiency diseases".

The consumption of wheat products in the United States was declared by Dr. Hale to have risen from 5.3 bushels per capita in 1915 to 5.8 bushels in 1920.

WALL STREET OFFERED GOLD FOR LEAD CENTURY AGO

People wanting to get gold for nothing or at least for less than the market value in labor or commodities, frequented Wall Street more than a century ago, Dr. C. A. Browne, chief of the U. S. Bureau of Chemistry, told members of the American Chemical Society at Milwaukee. Even in those early days "The Street" contained obliging philanthropists who professed to be able to give gold for a baser metal.

One of these was a Max Lichtenstein who actually professed to be able to transmute other metals into gold and who ran a laboratory until for one reason or another he saw fit to remove to Easton, Pa., where he continued in business for some time. Dr. Browne said:

"Within the past few years there have been gathered together a sufficient amount of documentary and literary material to prepare a volume on the history of alchemy in America".

The story of Lichtenstein was found in a publication called "The Talisman" issued in 1829.

Water at 706 degrees Fahrenheit and under pressure of about 3,200 pounds slips quietly from the liquid to the vapor state without boiling or bubbling.

THIRSTY SUGAR MAKES JELLIES JELL.

Thirsty sugar is in part responsible for the formation of fruit jellies, Prof. H. N. Holmes of Oberlin University told members of the American Chemical Society at Milwaukee. The sugar which is added to the fruit juice has an affinity for water which it takes from the pectin of the juice, leaving the pectin in a jelly-like condition. Other chemical substances have been found to have the same property but they are mostly poisonous or unsuitable for human consumption.

PRUSSIANS FIND MEASLES SERUM HELPS SAVE YOUNG CHILDREN

Serum from children recently recovered from measles is valuable in preventing measles in children under four years of age if injected soon after their exposure to the disease, the Prussian Central Public Health Bureau has decided, the American Medical Association here has just learned from its Berlin correspondent.

The Bureau has established centers for the collection of the serum in hospitals and has asked that general practitioners help supply the preventive fluid by sending recently recovered patients to them.

STREET-CARS SHAKE STARS; SCIENTISTS QUIT OBSERVATORY

Street-cars have shaken the stars of Bethlehem. Strap-hangers are not the chief complainants, however. Astronomers at Sayre Observatory of Lehigh University say that accurate work is rendered impossible by the cars passing a quarter of a mile away and they will abandon the observatory to amateurs and undergraduates.

For many years they have been photographing the stars by focusing the image from the telescope on the surface of a pan full of mercury and then taking a picture of the reflection. The car vibrations disturb the surface of the mercury and so blur the negative.

MAY EXTEND U. S. LEMON ZONE WITH DWARF CHINESE FRUIT

Introduction of a hardy dwarf lemon from China may result in extending the zone in which lemons can be commercially cultivated in this country, officials of the U.S.Department of Agriculture declare. This promising oriental citrus fruit was sent to this country in 1908 by Frank N. Meyer, explorer for the Bureau of Plant Industry. It was considered at that time that it might prove of value for house culture in the United States.

The new lemon has, however, outgrown the earlier expectations. Tests in various parts of the country have shown that this Chinese dwarf is not only valuable as a house plant, but that it is much hardier than the commercial varieties of lemons now grown. Its fruit is also of excellent quality.

TABLOID BOOK REVIEW

THIS EARTH OF OURS - By Jean Henri Fabre, Translated by Percy F. Bicknell. The Century Co. $2.50.

This is an exceedingly readable book. It is only unfortunate that Fabre's work should make itself known to English-reading people so late that we find the facts, which are so delightfully demonstrated, meager, and the theories, which explained those facts in Fabre's time, so largely outgrown. The translator is wise in inserting only the most necessary corrections in footnotes. It would be impossible to bring the book up to date and have the same book. Fabre still has us living only a few miles above the surface of a sea of molten rock and liquid fire which, rather miraculously, holds up the continents, but breaks out every little while through a safety-valve of a volcano. You wonder how it is that we do not fall in? Sh! It is due to the Hand of Providence!

It is not unexpected that a French book should present to us the paradox of explaining a "foreign" plain or mountain or such formation with which we are more or less familiar by likening it to some region of France of which we have never heard. But Fabre's provincialism does not end there. Mountains, deserts, the tropics, the arctic, and even the prairies are places so fraught with danger as to make life, either human or animal, there a most miserable business indeed. the collection of grisly stories which the author tells of all these lands may well make the French children echo the thankfulness of Stevenson's boy that, while "you must dwell beyond the foam", "I am safe and live at home".

Little Rollo and his father would have found this book entirely satisfactory. Modern childfen and their parents will read it with pleasure, but, alas! they wil have a great deal to unlearn. H.M.D.

Subterranean disturbances in Hawaii have caused the surface of the Lake of Living Fire of the Kilauea volcano to drop 600 feet below the rim, radio reports state.

A smokeless fuel has been successfully produced from coal in England

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So light are the strong duralumin metal girders of the Navy's new giant airship ZR-1, that a ten foot length of one of them can be easily lifted on a man's little finger.

Sportsmen in the Gobi desert of Central Mongolia use American automobiles to run down wolves and antelopes which they shoot with automatic pistols.

Fifteen new diseases of field and vegetable crops were reported in the United States during 1922.
